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ABSTRACT

This paper reports on an ongoing project at the University of Lethbridge (Alberta) to implement an interactive online multimedia World Wide Web site for communicating research and development results. The value of multimedia for activating rich knowledge structures is documented in the literature. However, using multimedia as a communication device for publishing research has been largely unexplored. A research and development project into online distributive education is used as an example of how this can be implemented. A multimedia portrayal table is included that provides links to data about the online course experience (e.g., tools used, student e-mail comments, student video interviews, and instructor interviews). (Contains 21 references.) (MES)

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Interactive Multimedia as Research Portrayal

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Abstract: This paper reports on an ongoing project to implement an interactive on-line multimedia web site for communicating research and development results. The value of multimedia for activating rich knowledge structures is documented in the literature. However, using multimedia as a communication device for publishing research has been largely unexplored. A research and development project into online distributive education will be used as an exemplar of how this can be implemented.

Introduction

The Faculty of Education at the University of Lethbridge (Canada) has been doing an ongoing investigation into the effectiveness and feasibility of online distributive education. A number of online courses have been developed as well as courses that are blends of online and face to face contact. As part of the development of these courses a number of custom tools were developed or generic tools were adapted. In addition, over the past years there have been a series of Science Institutes put on for practicing teachers in the field. These have been extremely popular and teachers have been enthusiastic about going back to their own classes with pragmatic ideas gained from these professional development sessions. However, one of the challenges of doing research into the effectiveness of these kind of initiatives is the degree to which text alone can adequately retell the participants' experiences or describe the tools. These initiatives can be set to words but words seem to fall short in describing an attitude reflected in the intonation of a voice or an interactive is easier to demonstrate than describe. In an effort to address these problems, a multimedia web site is under construction with the intent of communicating the results of that research to interested stakeholders. In this case the stakeholders are corporate sponsors, university administration, government granting agencies, colleagues doing similar research, and perspective participants. All of these stakeholders have an interest in the context of the course offering, its effectiveness, what the tools look and act like, and what participants thought of their experience. The web site is designed to showcase the results of the research and development efforts through various types of media. The media includes, pdf files, images, video clips, demonstration of interactive tools (shocked files), linked resources, etc. It is hoped that a multimedia approach can provide a richer experience than what text alone can provide.

Background

The literature on multimedia and its effectiveness is still quite sketchy but there is an overall sense that multimedia can have a positive impact on learning. There has been even less investigation into how multimedia can be used to enhance the communication of research results. Understanding how multimedia influences student learning, however, may transfer to interactive multimedia as a research portrayal. To that end this next section will provide a brief review of the literature into multimedia for learning and make connections to how it applies to multimedia research portrayals.

The definition of multimedia has changed over time. It started out as the idea of multiple media

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devices being used in combination. Because of technological advances, there is a blending of these mediums into one device, the computer (Kozma, 1991). It is the juxtapositioning of multiple representations that is the affordances of this tool; it is the combining of sound, still image, video, animation, text, music, and virtual reality to provide the user a multisensory experience. Interactive multimedia narrows the focus. Interactive suggests that users have a degree of control over the presentation of multimedia rather than being passively presented with the linear delivery of information. There are those that suggest interactivity cause students to spend more time on the material. Kennedy (1994) reports that using interactive multimedia allowed students to progress at their own rate and to quickly search information. It seems reasonable to suggest that researchers have strategies for reading textual reports that is anything but linear. A typical approach is to read the abstract, jump to the introduction and conclusion and then to a quickly skim of the rest, if something looks more important or relevant that it is read more intently. What if the structure of the document reflected this form of perusal? Interactive multimedia is easily setup to facilitate this kind of nonlinear exploration of the information (Campbell, 1997). For instance, if the reader wants more background they can drill down through the structure of the multimedia project. The other related issue is that the developers of the multimedia project can build in a great amount of data or content in bite-size pieces but the user retains the option of looking at it or not. Interactivity can be an important component of multimedia enabled publications.

Multimedia provides an environment where the users can explore the content from multiple perspectives. "Knowledge that will be used in many different ways has to be represented in many different ways, with the potential to form various combinations" (Spiro & Jehng 1990, p. 203). Studies indicate that problem solving is enhanced with the use of multiple representations (Steed, 1994; Crosby and Stelovsky, 1995). When text and images are presented concurrently this tends to result in better learning than if either are presented separately (Mayer and Sims, 1994). It is thought that if we are stimulated with more than one sense the experience is more meaningful and memorable. Pavio's research (Dual-coding theory) (1986) suggests that some kinds of knowledge can be reconstructed easier if images are used. It was also found that concrete words have a similar effect (words that paint a picture). Other research has shown that a combination of verbal and visual information are better than either presented separately (Mayer & Anderson, 91). Books use primarily text to activate knowledge structures but it has been found that if meaningful images are included it is useful and can particularly help novices (Kozma 91, Mayer, 91). The out shot of this is that there should be a correspondence between the nature of the research results and the way in which it is portrayed. When the research involves rich and thick descriptions then the form of representation should reflect that. For instance, video is an excellent medium for viewing a complex scenario where individuals are interacting with each other or their environment. Imagine that same kind of scenario described with words. A video is much easier to process because of the way the visual and auditory system parallel processes incoming information.

On the affective side, students express that they enjoy learning from multimedia (Atkins, 1993), but liking it may not correlate with learning. However, if the material can be made more interesting or engaging then surely that speaks to its effectiveness for communicating ideas. The audience will be more likely to pursue the information further and it will be more memorable because the multimedia experience potentially creates a richer set of connections, which are available when reactivating knowledge.

It was found that for students who needed conceptual organization of the content, creating hypermedia helped (Spoeher, 92). Multimedia often can graphically represent the structure of the content so it is visually accessible. Hypermedia students seemed to have richer knowledge structure than students who didn't engage in that activity and seemed better at organizing information (Spoeher, 93). Through the use of multimedia as a research portrayal tool perhaps there would be alternative ways of representing the logical structure of information. For instance, what if there was a conceptual map of the content, and each node on the map was a hot link that goes to a different level of organization, how might that type of portrayal change the way the audience represent ideas in their minds?

The notion of virtually being there, seeing the people and experiencing the tools that were used might move stakeholders to a better understanding. Stakeholders can more closely approximate the real world

experience by entering virtual worlds which provide the advantages of situated learning (Brown, 95). That emphasizes the importance of context and multimedia may be viewed as a much more immersive environment in the sense that you can potentially get a better sense for context, by seeing or hearing it. This potential benefit comes through the depiction of real-life situations with the use of digital photos, video, and sounds (Wissick, 1996).

There is a clear sense from the literature that cognitive style has an influence on the effectiveness of multimedia (Crosby and Stelovsky, 1995). Those with visual spatial tendencies tend to do better in multimedia environments whereas those with low spatial ability are thought to require more cognitive energy to build connections between representations (Mayer and Sims, (1994). This supports Howard Gardner's concept of multiple intelligences (1983) that suggests each individual has different ways of knowing: mathematical, linguistic, musical, spatial, bodily kinesthetic, interpersonal and interpersonal, etc. Traditional research publications for the most part are represented in linguistic forms, by enabling multimedia forms, alternative learning styles might be activated that would engage the stakeholder in the content to a greater extent.

Interactive multimedia has potential pitfalls. For instance, interactivity can back fire; allowing users freedom of control may result in information that is skipped over or never viewed at all. It is suggested by some that students have poor self-regulation behaviors for making informed decisions about their learning path through multimedia materials. Clark, R. E. (1993) challenges the value of interactive multimedia and suggests we need more research. Educators on the whole seem less likely to accept visual portrayal as opposed to verbal or written arguments. Think about the kind of tools that are provided students during an exam, technology is rarely considered a necessary tool. Despite this, multimedia has such potential for providing metaphors or leverages to create mental imagery (Reiber 1995) and to help us communicate (Dede, 91).

The use of multimedia as a form of portrayal for communicating research results is something, which needs further discussion. It potentially provides a multisensory experiences which works to reinforce and highlight dimensions of the data, the researcher can use multimedia to express ideas in new ways, and it extends the definition of what is considered data (Campbell, 1997). Campbell goes on to suggest that using multimedia as a portrayal tool facilitates triangulation of data because different media types can be cross linked and represent the same concept from different perspectives. This in turn addresses credibility in qualitative research. Multimedia also lends itself to transferability through rich and thick descriptions available through video and audio elements. Understanding that alternative forms of representation have value for negotiating meaning should help us move in this direction. Second, building structures that encourage such options should be considered because we don't all think and process information in the same way and multimedia provides us with multiple representations.

There is a growing trend to use multimedia as tool to present and document educational research. The nature of emerging tools lends itself to new ways of gathering, analyzing, and sharing those results (Goldman-Segall, 1995). The benefits to learning listed above in the literature review are justification for using multimedia but there is another reason that seems to have an equal, if not a greater influence, that is the Internet. The advent of the Internet has inadvertently injected multimedia capabilities into electronic publications. As research publications move to the World Wide Web to facilitate dissemination, they naturally set themselves up for other forms of portrayal besides static images and text. Despite the potential the technical barriers for doing this are not insignificant. For instance, this document is published in PDF format and it was noticed that the sample RTF file implicitly suggests sticking with standard text and still image type of forms. What if the publication were to have a section on how to include other types of multimedia elements like, video clips, animations, virtual reality (VR), and sound files. The Internet provides a partial solution in that a URL can be imbedded in a document and interested individuals can link to that and see other types of information but then it is not part of the published work per se. Limited bandwidth is another limitation Most people are still hamstrung with slow connection speeds but that is changing quickly with the implementation of cable modems and ADSL connections. CD and now DVD provide a viable alternative in situations where large multimedia elements are intensively utilized.

The Web Site

To illustrate the concept and value of alternative forms of communication, a web site is being created as an exemplar. This web site will portray research done into the usefulness of online distributive education over the Internet. The secondary goal of the project is to facilitate the communication of tools, ideas, and experiences through multisensory experiences. In order to accomplish this, the demonstration and description of the tools are juxtaposed with supporting textual, auditory, and visual elements. These multimedia elements provide a rich source of information while the interactive component provides the audience an individualized route through the content. There are four kinds of data that the project uses in the web page. This is data collected through video taping sessions of both instructors and students (formal interviews or otherwise), anecdotal comments made through email messages or submissions to online databases, verbal descriptions of the tools and how they were used, and animated demonstrations of online tools. The intent of this is to allow other participants of these online courses and interested educators, an opportunity to hear the voices of students who have used the online components, get a feel for the kinds of issues raised through email correspondence, and sense for the tools that were used.

Before placing the video clips in the public domain, participants sign a release form and are given the opportunity to preview them to ensure they agree with the intent and the context they will be used in. Student participation is optional, as stated in the consent form.

Below is information that appears on the web page. The textual description is there to ensure there a context to the information. However the multimedia portrayal table is the driving interface for accessing the multimedia components. A table was decided on because the structure of the information (tools versus portrayals) matched the structure of the tool. This table acts like an index and links the audience to a desired section.

Background:

This study is sponsored by the Information and Communication Technology Research and Development (ICTR&D) project in the Faculty of Education at the University of Lethbridge, Alberta, Canada. The objective of this project is to study the effectiveness of on-line distributive learning. This document will use a variety of portrayals to represent the online tools which have been used to enhance online learning. It is hoped that such descriptions and representations will facilitate decision making for other educators and to communicate the nature of the experience.

Purpose:

The term "distributive" suggests that learning is not just the delivery of information but that information becomes transformed to knowledge and understanding. This process involves more than passive involvement so part of the mandate of this project is to explore diverse instructional strategies that engage the learners with the course materials, with other participants, and the instructor. This report will not make summative judgments as to the effectiveness of the tools nor the instructional design, rather it will provide context and data to help draw your own conclusions.

The Multimedia Portrayal Table:

Below you will view a table of links that will assist in creating a representation of the online course experience. Clicking on the various cells will open a new window with more information. Once you have viewed that information and want to return to this page, close that window. The data has been

drawn from an education graduate course, Educ 5410, Program Evaluation, offered in the Spring of 1999. The course was totally online. There were two sections of the course offered but only one class was sampled for video interviews, one that was totally done online and one that had a number of components online. The student information below comes from the totally online course but the instructor perspective comes from both offerings. The students were selected based on the instructor's view of a broad perspective (students who struggled and those who excelled and some in between). The description will provide a textual account of the tools, the samplers are illustrative examples of the tools, student email comments are email correspondence from students related to that tool, student video interviews are video taped interviews with a sample of the class, and the instructor video interviews will provide the instructors' perspective.

NOTE: S1, S2, S3 represent links to video taped interviews of different students, I1 and I2 represent links to video taped interviews of different instructors, likewise comment 1, comment 2, represent different student comments from email submissions. In the web version all the items in the table will be hot links, unfortunately in this version the links don't work.

Multimedia Portrayal Table

Description of the Tool	Sampler of the Tool	Student email Comments	Student Video Interviews	Instructor Video Interviews
Online Course Outline	**Sample Online Course Outline**	**Comment 1** **Comment 2** **Comment 3**	**S1** **S2** **S3**	**I1** **I2**
Online Gradebook	Instructors View: Instructor Log-in Add Student Class Summary Students View: Student Log-in Student Summary Change Password	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Online Reflections	**Online Form** **Student Search Page** **Instructor Search Page** **Log In Instructional Movie** [Shockwave]	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Newsgroups	**Newsgroups** **Log In Instructional Movie** [Shockwave] **Threading Instructional Movie**[Shockwave]	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Listservs		**Comment 1** **Comment 2** **Comment 3**	**S1** **S2** **S3**	**I1** **I2**
Email		Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Course Search		Comment 1	S1	I1

		Comment 2 Comment 3	S2 S3	I2
Active Course Maps	**Sample course map** (PDF format)	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
PDF Files	Sample pdf	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Online Instructions/Help	Newsgroup: **Threading Instructional Movie**[Shockwave] Grade Book **Log In Instructional Movie** [Shockwave]	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2
Online Questionnaires and Forms	**Hardware/Software Platform Survey** **Computer Skills Survey** **On-Line Course Evaluation**	Comment 1 Comment 2 Comment 3	S1 S2 S3	I1 I2

Table 1: This is a multimedia portrayal table which illustrates links to multimedia elements.

Students and instructors were asked additional questions relating to their overall experience with online education and their responses are listed in the tables below:

Describe the advantages of online courses.

Student Video Interviews	Instructor Video Interviews
S1	*I1*
S2	I2

Table 2: This is a multimedia portrayal table which illustrates links to multimedia elements..

Describe the disadvantages of online courses.

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 3: This is a multimedia portrayal table which illustrates links to multimedia elements.

How was your experience or learning different with an online course?

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 4: This is a multimedia portrayal table which illustrates links to multimedia elements.

How would determine if an online course is worth taking? List the criteria you would use.

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 5: This is a multimedia portrayal table which illustrates links to multimedia elements.

Comment on anything else in regards to the online component of the course you would like to share.

Student Video Interviews	Instructor Video Interviews
S1	I1
S2	I2

Table 6: This is a multimedia portrayal table which illustrates links to multimedia elements.

This web page is intended to provide stakeholders with a altered perspective about the effectiveness of this online course because of the multimedia elements that are present. The actual web page can be accessed through the following URL:

http://www.edu.uleth.ca/ICTRD/report/site2000.html

Conclusions

This project is a work in progress, but the long-range intent is to research the effectiveness of multimedia for communicating research. Researchers and educators alike will be able to use the principles coming out of this project and apply those to their own multimedia publications. It is also hoped that this will facilitate a move by journals, conference proceedings, and professional associations to encourage and facilitate the creation of multimedia enhanced publications.

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